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Express Label No.: EL 846221504 US

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1 PRINT BY REFERENCE SERVICE METHOD

3 FIELD OF THE INVENTION

4 A field of the invention is print servers. Other fields of the invention
5 include print data services, wireless portable devices, and web based services. The
6 invention provides support of print by reference operations in which print content
7 is addressed by a reference, such as might be supplied by a wireless portable
8 device or a print device.

10 BACKGROUND OF THE INVENTION

11 The traditional model for print operations is the pushing of content
12 to a print device from a device. Most often, this involves a computer
13 communicating with a print device, e.g., a printer or multi-function peripheral
14 including a print function. The communication may follow the format of wired
15 connection interface, such as the case where a print device connects to a print
16 device over a serial or parallel computer port. The communication might also
17 follow a wireless connection such as that used for communication through an
18 infrared port. The basic operation in either case involves a device, e.g., a
19 computer, linking to a computer, converting content into a format acceptable to the
20 print device, and then transferring the data to the print device. As an example, a
21 computer printing a Microsoft Word document addresses a print device, converts
22 the document data and format information into a print device ready format, and

1 pushes the data to the print device. Protocol standards handle the communication
2 between the print device and the device pushing the data to be printed. Print
3 servers, typically software resident or cooperative with a data generating program,
4 convert data into a native print device format.

5 The traditional model limits print operations in a number of ways.
6 One important limitation is the inability of the print device to be used by devices
7 lacking the ability to convert data into a print device ready format. Even if this
8 inability were overcome by some manner, another limitation concerns the practical
9 limits of the types of devices and device connections that may utilize a print
10 device. Specifically, devices that lack sufficient memory resources to store data to
11 be printed are, as practical matter, unable to make effective use of a print device.
12 In addition, devices that lack a sufficiently fast or sufficiently reliable
13 communication link to the print device also may not effectively use the print
14 device. A particular class of devices that might lack sufficient memory for print
15 content, or a fast enough device-print device interface, or a reliable enough device-
16 print device interface, are portable wireless devices. Personal digital assistants
17 (PDAs), cell phones, wireless data terminals and other wireless devices would
18 have increased usefulness, and add increased usefulness to print devices, if the
19 wireless devices had efficient print capabilities.

20 SUMMARY OF THE INVENTION

21 Print by reference expands printing and the usefulness of wireless
22 devices and print devices by permitting a reference to data content that is to be
23 printed to be passed from a device to initiate a print job. The invention concerns a
24 service to support the print by reference operation. The service method accepts a
25 reference to content, transcodes the content, and establishes the transcoded content
26 to be taken for printing.

27 In a preferred embodiment, a print service of the invention executes
28 a method that accepts, from a print client, a reference to print content targeted for
29

1 printing from a location indicated by the reference. The reference is resolved to
2 determine the location indicated by the reference. Print data is obtained from that
3 location and transcoded into a print device ready format. The print client is
4 allowed to access print ready formatted data, which may be transferred to the print
5 client in response to a request from the print client.

6 In a preferred embodiment print service of the invention, preferably
7 realized as a web site or part of web site, software hosted or accessible by the web
8 site performs the required functions. A print client may be a print device, for
9 example, that has an Internet connection. A print client might also be a portable
10 wireless device, for example, which then might transfer data transcoded by the
11 print service to a print device. The print service method provides commercial
12 potential for web services and content provider partnerships, as a preferred use of
13 the print service might commence with a user of a portable wireless device
14 obtaining a reference to print content while web surfing, communicating that
15 content, for example via a Bluetooth wireless connection to the print device, which
16 then uses the print service to resolve and process the print by reference
17 communication. Similar commercial potential is possible with respect to print
18 device manufacturers and the manufacturers of portable wireless devices, such as
19 personal digital assistant (PDA) devices.

20 BRIEF DESCRIPTION OF THE DRAWINGS

21
22 FIG. 1 illustrates a preferred example environment for
23 implementation of the present print by reference service method;

24 FIG. 2 is a flowchart of sequence of steps of a preferred method of
25 the present invention;

26 FIG. 3 illustrates a preferred print service interface;

27 FIG. 4 illustrates a preferred method of job control for a print service
28 method of the invention.

1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

2 A print service method is provided by the invention for supporting
3 print by reference operations being conducted by a print device. In a preferred
4 form, the print service method is provided through a web site that is used by a
5 print device handling a print by reference operation. The print service might also
6 be part of print device software, as another example. Print device software
7 performing the method of the invention might therefore be part of the software
8 executed in printers or multi-function peripherals, as well as peripheral print
9 devices such as HP JETDIRECT® devices, including internal JETDIRECT®
10 cards or external JETDIRECT® plug in print server devices. A device including
11 software for executing the print service method of the invention generally requires
12 direct or indirect access to print content to be referenced by print by reference
13 operations. The most important type of content and the content likely to be
14 referenced in the print by reference operations is accessed via the Internet, and the
15 preferred direct or indirect connection is therefore a direct or indirect Internet
16 connection.

17 In the case of a remote print service accessed via the Internet, the
18 transcoded data transfer to the print device is preferably conducted with the print
19 service setting up a Universal Resource Locator address for the transcoded data
20 and then communicating the Universal Resource Locator address for the print data
21 to the device.

22 FIG. 1 shows a preferred environment for implementing the print
23 service method of the invention. A print device 10 accesses a print service of the
24 invention, either via the Internet to a web site print service 12, or through another
25 connection to a local print service 14 that may comprise software in the print
26 device 10 when the print device 10 is carrying out a print-by-reference operation.
27 While the local print service 14 is shown as an external device to the print device
28 10, it may also be internal to the print device. For example, it may be native
29 software or an add on software. It might also be installed as a firmware card.

1 The print device uses the print service 12 or 14 to resolve and
2 access the content to be printed. With the print device 10 being accessible to a
3 portable wireless device 16, the print service 12 or 14 can therefore aid a print by
4 reference operation initiated by the portable wireless device 16. From the
5 perspective of the print service 12 or 14, either of the print device 10 or portable
6 wireless device 16 may be viewed as a print client for a print by reference
7 operation irrespective of whether the "print client" is directly or eventually making
8 use of the print service 12 or 14. A likely scenario involves the portable wireless
9 device 16 accessing a content provider 18, typically a web site over the Internet.
10 The web site might include a link to print content, such as a "print-this" link. If
11 selected, the print by reference target is transmitted to the portable wireless device
12 16, which then can commence a print by reference operation with the print device
13 10. In the preferred environment of FIG. 1, the portable wireless device uses
14 Bluetooth wireless 20 to communicate a print by reference target to the print
15 device 10 or, perhaps, directly to the print service 12 or 14. The print device 10
16 then accesses the print service 12 via an Internet interface 22. However, the print
17 services 12 or 14 may be accessed in other manners including, for example,
18 cellular network communications or RF.

19 Bluetooth is a preferred wireless RF standard developed by a
20 technology industry consortium made up of 3Com, Ericsson, IBM, Intel, Agere,
21 Microsoft, Motorola, Nokia, and Toshiba with a mission of creating a standard
22 wireless protocol. More information, including protocol specifications, can be
23 obtained on the Bluetooth website: www.bluetooth.com, with the content available
24 from this and linked websites incorporated herein by reference. The current
25 Bluetooth protocol has an operable range of about 10 meters, but may sometimes
26 prove to have greater range. As an example software/device for the underlying
27 Bluetooth communication usable by the print services 12 and 14, the print device
28 10 or the portable wireless device 16, a Bluetooth PC card was unveiled by 3Com

on May 29, 2001. The card follows the new Bluetooth 1.1 specification and uses 3Com's connection manager software.

Other example communication protocols suitable for practice within the scope of the invention that have available commercial support are those specified by IEEE 802.11 standard. 100 meters is the optimal 802.11 maximum range, but 802.11 can work at around 300 meters. However the data rate goes from 11 Mega bits per second to about 1 or 2 Mega bits per second as range increases. Bluetooth power class III is designed for 10 meters at low power. Bluetooth Power class I uses 100 milliwatts and can go about 100 meters. Artisans will also appreciate that wireless protocols other than 802.11 and Bluetooth, e.g., infrared, might also be used and that certain preferred features, e.g., an OBEX connect are therefore unique to the preferred Bluetooth embodiment since the Bluetooth protocol requires a CONNECT while OBEX does not.

For example, the wireless device 16 typically has Internet access. This Internet access may be through a cellular network interface 24. The print service 12, preferably a web site, would have an Internet interface 26. The print service 12 may therefore be realized as a web site by software resident in a web host. The content provider 18 is also typically a web site, and therefore would have an Internet interface 28, as well. The local print service 14 requires an Internet interface 30 to access a content provider that is a web site. The interface 30 may be the same interface used by the print device 10.

A number of paths for passing a print reference and channeling print data and print services are therefore possible. Alternate preferred embodiments include the use of the local print service 14 with either the print service 14 or the portable wireless device 16 accessing the content provider 18. Either of the print services may be accessed by the print device 10 or the portable wireless device 16.

Referring now to FIGs. 1 and 2, either one of the print services 12 or 14 accepts a reference 32 to print content targeted for printing from a location indicated by the reference. The print service 14 accepts the reference, for

1 example, directly from the print device 10. The print service 12, on the other
2 hand, accepts the reference via Internet interface 26. The print service 12,
3 however, may also receive the reference 32 from a wireless connection to the
4 portable wireless device 16. This connection might be via Bluetooth 20 or the
5 cellular network interface 24.

6 A print service needs to be discovered or located by a print device or
7 portable wireless device before it can be used, which thus may be a preliminary
8 step to accepting a reference. Discovery may occur in a number of different ways.
9 Some preferred possibilities are the following models for print service discovery.
10 The location of a print service may be pre-configured 34 into a print device 10 or
11 portable wireless device. Another alternative is for a print service to be registered
12 36 into a service registry. Print devices and portable wireless devices can use the
13 registry to locate a print service based on some set of search constraints. Alternate
14 search based discovery 38 is also possible, e.g., any form of search engine. A
15 print service can also be located 40 via network discovery protocols.

16 The print service 12 or 14 resolves a reference 42 to determine the
17 location indicated by the reference, typically a content provider 18 accessible by a
18 Universal Resource locator. In that typical case, the reference will be a Universal
19 Resource Locator that addresses print content targeted for printing. The accepted
20 reference may be an individual reference, or multiple references. Accepting a
21 reference thus may be accepting a reference list of individual references that
22 individually reference print content stored at a location, e.g., a list of multiple
23 Universal Resource Locators to resolve 22. Preferably, each reference in a list is
24 processed separately followed by complete sequential processing of remaining
25 references in a list.

26 The print service 12 or 14, after resolving a reference 22, then
27 obtains the print data 44 from the location indicated by the reference. The print
28 service 12 or 14 transcodes the print data 46 into a print device ready format, then
29 allows access to the transcoded print data 30. Transcoding is translating obtained

1 data into a form that can be used for printing. Preferably, the transcoding changes
2 data into form independent of the print device type (brand) used. Preferred
3 example formats include HTML, ASCII, and PDF. Alternatively, the transcoding
4 can translate the data into print formats dependent upon the type of print device.
5 Dependent formats may be the proprietary formats used by different print device
6 manufacturers. Recognition of an appropriate format is a concern with the remote
7 print service 12, but the print service 14 embedded within or peripheral to a
8 particular print device 10 can likely have transcoding tailored to the particular
9 print device. The transcoded print data is transferred 48 to the print device 10 in
10 response to a request from the print device 10. In the case of the remote print
11 service 12 accessed via the Internet, the transcoded data transfer to the print device
12 10 is preferably conducted with the print service setting up a Universal Resource
13 Locator address for the transcoded data and then communicating the Universal
14 Resource Locator address for the print data to the device.

15 At the time of accepting a reference 20, the print service 12 or 14
16 also may initiate a control communication 50 with the print device 10. As seen in
17 FIG. 3, a control channel 52 and data channel 54 may be separate. In FIG. 3, the
18 control communication is preferably conducted via an argument resolution
19 protocol 56 namely, the SOAP protocol (Simple Object Access Protocol). The
20 preferred data channel 54 uses an HTTP protocol. The control channel 52 is
21 convenient for passing arguments and responses. Such a need for responses can
22 occur when accessing the location including the print content, e.g., the content
23 provider 18. Print service communications are layered on top of HTTP (HTTPS
24 when secure access is used). HTTP is preferred because it provides an efficient
25 and ubiquitous transport mechanism.

26 SOAP is preferably used to define three actions that are exported by
27 the print service, job create, status check and job cancel. These actions along with
28 generic HTTP access (HTTP GET and POST) support the requirements for the
29 remote print service 12. A client initiates a print job using CreatePSJob 60. This

1 action provides the print service 12 with information required to create a print job
2 and to begin the processing of a print operation.

3 In a preferred protocol, the print service 12 creates a unique Job
4 Identifier (*JobID*) that can be used in subsequent operations to identify the print
5 Job. CreatePSJob supports both print by reference and information upload as a
6 means of providing content to the print service 12. If the client is printing a
7 reference then this is sent the *Reference* argument of action. If the client plans to
8 upload information to the print service it does not specify a reference argument in
9 the action request. When the client indicates that it wants to upload the
10 information to be printed the client can include a *DataSink* URL in the
11 CreatePSJob response. The client must then send the information to the print
12 service 12 using a separate HTTP POST operation to the *DataSink* URL. The print
13 service 12 also returns the *JobID* and a *PrintSrc* URL to client. The *PrintSrc* URL
14 is used to retrieve the print ready information once the print service 12 has
15 transcoded.

16 The reference, e.g., web site, might issue a security challenge as the
17 print service 12 or 14 attempts to obtain the print data. In that case, the print
18 service 12 or 14 accepts a security challenge 44 (FIG. 2) from the print data
19 content location, e.g., content provider 18. The SOAP protocol 56 can be
20 conveniently used to conduct a security communication 62 (FIG. 2). This
21 communication 62 might pass on the security challenge to the print service 12 or
22 14 obtain information necessary for response, if the information was not initially
23 provided to the print service 12. When the print service 12 or 14 has information
24 necessary to respond, it then may respond to the security challenge.

25 The print service 12 or 14 may respond to the security challenge in a
26 number of preferred ways. Access credentials may be included in the reference to
27 content that is provided to the print service, and are thus received at the time that
28 the print service accepts a reference in step 32. If not initially provided when the
29 print service accepts a reference, the print service may pass the challenge back to

1 the client who then may re-submit the request with the correct security information
2 included. Another option is for the print service to support privacy through the
3 encryption of the information exchanged between the print service and client, e.g.
4 between print service 12 and the print device 10. This encryption can be imposed
5 at the link level, e.g., HTTPS or IPSec, at the time of connection set-up. Since this
6 level of security occurs at the link level it has no affect on the method of print by
7 reference communications between the print service 12 and client, i.e., the print
8 device 10 or the portable wireless device 16. Another approach is to have the
9 information encrypted above the link level. An encryption/decryption and/or
10 identification key can be used in print by reference communications with the print
11 service.

12 The control channel also may be used to conduct job control. Job
13 control allows the print service 12 to manage individual print by reference jobs,
14 and allows handling of multiple jobs from separate clients. Multiple job handling
15 is important if the print service 12 is to serve independent business services. For
16 example, a print service web site hosting a print service of the invention for print
17 by reference operations might be a paid service. Such a print service web site
18 might alternatively be a supplement to some other commercial transaction. Thus,
19 a purchaser of a print device 10 or a portable wireless device 16, or a purchaser of
20 web services or wireless airtime might obtain access to a print by reference print
21 service web site that implements the invention.

22 Job control is especially important for the remote print service 12, as
23 it is likely to handle multiple jobs and deal with diverse print devices and portable
24 wireless devices as different clients. FIG. 4 generally illustrates a preferred job
25 control communication. Preferably, when the print service accepts a print by
26 reference request, a print job is created 64 and a job identifier is assigned 66 to the
27 print job. The job identifier is communicated to the print device 68, or
28 alternatively a portable communication device if the portable communication
29 device is communicating with the print service. Subsequent print control

operations through the control channel 32 are conducted using the assigned job identifier to link operations to a particular print job. The print service 12 can preferably support a reflected user interface (RUI). The RUI is a web page used to control the print job using a web form that is reflected back to the user of the portable wireless device 16. The user would then be able to select options or fill out the form to provide job control parameters. The job identifier enables, for example, the print service to include the job identifier as a state variable that the print device 10 or the portable wireless device 16 returns as a result of selecting a hyper link included in the RUI web markup.

It is preferable for the print service 12 or 14 to permit a client print device or portable wireless device to set attributes. Thus, the print service 12 or 14 should accept print attributes 70. The attributes may determine the outcome of the print operation. The print service should also provide for default attributes 72 in the event that some or all attributes are not provided by a print service client, i.e., the print service 12 or 14 supports a standard set of print options. Extensions to the standard set of print options should be supported 74 to allow for evolution and support of differentiated vertical markets. Supporting extensions allows for updating of the print service 12 or 14 to account, for example, for new print formats and new print devices.

The print service 12 or 14 also should obtain some understanding of the client's capabilities 76. The step of transcoding 46 translates the print data into a print device ready format, thus requiring some knowledge of the capabilities of a particular print device client and its configuration in order to provide print ready information. A client, i.e., a print device or portable wireless device, should also be provided with some forms of job control 78. Examples are the ability to query the status 80 (see FIG. 3) of a print job or to cancel a print job 82 (see FIG. 3).

Security of the remote print service 12 can be a separate issue from the security of the content provider 18. A remote print service may need to protect

1 itself from unauthorized use. To support this need the print service can provide a
2 separate security check 80 for the print service to discover the identity of the client
3 device to enforce access control. The server security check 80 is preferably
4 conducted at the time that a print job is created 64. One option for the security
5 check 58 is to require the client to provide credentials 60 in order to access the
6 print service 12. The security check can be similar to the manner for checking
7 security in response to a challenge by the content provider 18. Billing may be
8 addressed with the security check for the print service, as the print service 12 or 14
9 may require billing ID 82 for use by a client. The print service 12 or 14 could use
10 any standard or widely used billing models for the financial clearance conducted
11 as part of a security communication 62.

12 In the case of the remote print service 12 accessed via the Internet,
13 the transcoded data transfer to the print device 10 is preferably conducted with the
14 print service setting up a Universal Resource Locator address for the transcoded
15 data and then communicating the Universal Resource Locator address for the print
16 data to the device.

17 While a specific embodiment of the present invention has been
18 shown and others described, it should be understood that other modifications,
19 substitutions and alternatives are apparent to one of ordinary skill in the art. Such
20 modifications, substitutions and alternatives can be made without departing from
21 the spirit and scope of the invention, which should be determined from the
22 appended claims.

23 Various features of the invention are set forth in the appended
24 claims.